These problems are intended to help you verify your level of preparation for Test 1. They are not intended to cover every topic you could be tested on. Make sure you attend the review lecture!

**Multiple Choice (including short problems)**

_____ 1. An electron is placed in a uniform electric field of 1.5x10^4 N/C. The magnitude of its acceleration is [A] 8.54x10^-8 m/s^2, [B] 2.20x10^7 m/s^2, [C] 2.63x10^15 m/s^2, [D] 1.65x10^34 m/s^2.

_____ 2. More electric field lines are found to enter a Gaussian surface than to leave it. Which of the following statements about the net charge inside the surface is true?
   [A] The charge is positive.    [B] There is no charge inside.    [C] The charge inside is negative.

**Problems**

3. A rod is bent into a half circle of radius \(a\), centered on the origin as shown.
The rod carries a total positive charge \(+Q\) uniformly distributed over its length.
(a) Express the linear charge density \(\lambda\) on the curved rod in terms of the total charge \(Q\), and the radius \(a\).
(b) Obtain an expression for the \(x\) and \(y\) components of the electric field produced at the origin by the curved charged rod alone. Express your answer in terms of any symbols in the figure, and one of the constants \(k\) or \(\varepsilon_0\).
(c) If a proton (charge \(+e\)) is now placed at the origin, what force will it feel? Express your answer in **unit vector notation**.
(d) Derive an expression for the electric potential at the origin.

4. Calculate the minimum initial speed an electron needs to have in order to escape from a proton a distance \(D\) away. Assume the proton remains at rest.

5. A solid insulating spherical shell of inner radius \(a\) and outer radius \(b\) has a uniform charge per unit volume \(\rho\). Concentric with this spherical shell is an uncharged conducting spherical shell with inner radius \(c\) and outer radius \(d\). The figure shows a cross section.
(a) Begin with Gauss’ Law, sketch the Gaussian surfaces, and find the magnitude of the electric field in the regions \(r<a\), \(a<r<b\), \(b<r<c\), \(c<r<d\), and \(r>d\). Justify all steps in your solution.
(b) Determine the charge induced on the inner and outer surfaces of the conducting spherical shell.

6. For the capacitor circuit shown, \(C_1 = 4 \mu F\), \(C_2 = 2 \mu F\), \(C_3 = 4 \mu F\), and \(C_4 = 6 \mu F\).
(a) Find the equivalent capacitance.
(b) The charge on capacitor \(C_4\) is 6 \(\mu C\). Determine the charge on the other capacitors, and the applied voltage \(V_{ab}\).
Physics 2135 Exam Rooms  
Fall 2015  
5:00 - 6:00 PM

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Special Accommodations Testing Center

Know the exam time (5:00 pm to 6:00 PM)!
Find your room ahead of time!

These room assignments will be posted on the doors to 104 Physics.

BCH = Butler-Carlton Hall (Civil Engineering)
H/SS = Humanities/Social Sciences Building